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NOTES ON THE MARINE SEDIMENTS OF EASTERN OREGON.

THE marine sediments of eastern Oregon comprise beds ranging from the Carboniferous to the Upper Cretaceous. The Carboniferous and Triassic have been described by Waldemar Lindgren,¹ the Jurassic by Alpheus Hyatt,² and the Cretaceous by John C. Merriam,³ C. A. White,⁴ W. M. Gabb,⁵ J. S. Diller and T. W. Stanton,⁶ and Professor Blake.⁷ The present paper is written to demonstrate the Carboniferous age of the limestone of Baker county, and to describe new localities of the Paleozoic and the Mesozoic in eastern Oregon.

The Carboniferous.—Lindgren⁸ has described and mapped a great series of metamorphic argillites and limestones in Baker county, which he refers with doubt to the Carboniferous. Fossils are scarce in these rocks, the only ones reported by Lindgren being some round crinoid stems.

In the early eighties some fossiliferous limestone was sent to Professor Condon from Powder river, below Baker City. Professor Condon recognized the fossils as *Producti*, and hence sufficient to prove the Carboniferous age of the Baker county limestone that Lindgren maps as Carboniferous. Recently, through the help of Mr. H. G. Moulton, Mr. N. C. Haskell, Mr. Thomas Burke, and Mr. L. W. Nelson, of Baker City, the position of the

¹"Gold Belt of the Blue Mountains," *Twenty-second Annual Rept. U. S. Geol. Surv.*, Part II, pp. 577-82, 1902; *Science*, Vol. XIII, pp. 270, 271, 1901.

²"Trias and Jura in the Western States," *Bull. Geol. Soc. Am.*, Vol. V, pp. 418-20, 1894.

³"Contribution to the Geology of the John Day," *Bull. Dep't Geol., Univ. of Calif.*, Vol. II, No. 9, pp. 280-85.

⁴*Bull. 33, U. S. Geol. Surv.*, p. 19; *Bull. 15*, pp. 31, 8; *Bull. U. S. G. S. Terr.*, Vol. II, p. 359.

⁵*Paleon. Calif.*, Vol. II, pp. 138, 181.

⁶*Bull. Geol. Soc. Am.*, Vol. IV, pp. 214, 452, 453.

⁷*Am. Jour. Science*, 1867, p. 118.

⁸*Twenty-second Annual Rept. U. S. Geol. Surv.*, Part II, p. 578.

limestone has been ascertained and more fossils collected from it. Mr. Nelson writes that he found the fossils *in situ* in limestone east of Big creek, about three miles south of Medical Springs. He says that the limestone extends in a broken line through Tp. 7 S., R's. 41, 42, and that it contains fossils in many places. Lindgren's map shows only Triassic in this vicinity. The fossils were referred to Dr. George H. Girty, to whose kindness the writer is indebted for the following report:

The unfortunate preservation of the material from Oregon is such as to render a nice discrimination of species impossible. Among the *Producti* there appear to be at least three species, one of these a large, comparatively flat, and spreading shell, which cannot be identified. Another group consists of small shells, which can be almost exactly duplicated in *Marginifera splendens* N & P of the Mississippi valley, a species frequently cited as *Productus longispinus*. I have not, however, been able to make out the internal characters distinguishing the genus *Marginifera*. The third group comprises forms more or less closely related to *Productus multistriatus* Meek. All of these specimens are smaller than typical *P. multistriatus*, and some are more coarsely striated. These shells vary so much in these two characters, size, and striation, that I suspect that more than one species is represented. The material, however, will not permit this fact to be satisfactorily determined. Besides the forms mentioned are a *Spirifer* or *Spiriferina* (probably the latter), a *Seminula* not unlike some forms of *S. subtilita* from the Mississippi valley.

The only other place in eastern Oregon in which Paleozoic fossils have been found is on upper Crooked river. The fossils occur in partly crystalline limestone on upper Beaver creek, near the crossing of the Prineville-Izee wagon road. They were discovered by Mr. John Platts and the writer while on a bicycle trip in 1899.

Dr. Girty reports on them as follows:

The following species have been identified:

Zaphrentis sp.

Brachiopod?

Aviculopecten sp.

Pseudomonotis sp.

The shell referred to as Brachiopod is indeterminable.

The third-mentioned form is probably an *Aviculopecten*, but it belongs to no species with which I am familiar, and certainly not to the common Carboniferous ones.

A species of *Zaphrentis* seems to be quite common and, as this type of coral is restricted to the Paleozoic, its presence seems to indicate, though broadly, something definite with regard to the age of the beds.

The fourth form, however, is somewhat contradictory. Several paleontologists to whom I have shown it know nothing similar to it in the Paleozoic. I am forced to conclude either that it is something entirely new or that its preservation has obscured its real character. It seems to resemble *Pseudomonotis* more than any other genus I know, but it is quite unlike, in its peculiar surface markings, any members of the genus yet found in this country. *Pseudomonotis*, it should be remarked, is especially distinctive of the Permian period.

On the whole, I am forced to conclude that the fauna indicates Carboniferous, though it may, in fact, be Devonian. Evidence of a more conclusive character is desirable to really establish the age of these beds.¹

The *Aviculopecten* mentioned by Dr. Girty was not found in the limestone with the other fossils, but in siliceous shales which dipped away from the limestone for at least ten miles eastward to Izee post-office, where the fossil was found. The shales are well exposed along the north side of the south fork of the John Day for several miles below Izee. How far they continue east of Izee I do not know, since we turned north at Izee and passed over basalt most of the distance to Canyon City. All of the rock that was not basalt was on the Canyon City end of the road and either serpentine or coarse-grained igneous rock. The shales on the south fork did not seem as much metamorphosed as the Pitt shales of northern California and would likely yield plenty of fossils. From the fact that they overlie the Paleozoic limestone and dip toward undoubted Jurassic strata twenty-five miles southeast, the shales are possibly Triassic.

The Triassic.—The Triassic was first reported from eastern Oregon by Waldemar Lindgren.² From Lindgren's beds near Wallowa Lake, in T. 3 S., R. 44 E., Secs. 9, 10, 14, 15, 35, 36, a great many *Halobiae* have been sent to Professor Condon by Mr. Charles Cambell, Mr. Oglesby, and others. The collections

¹ No "well-defined Carboniferous," nor indeed any Paleozoic but this, has been reported from Crooked river. Lindgren was mistaken in thinking Professor Condon had found such rocks there. (*Twenty-second Ann. Rept. U. S. G. S.*, Part II, p. 579.)

² *Twenty-second Ann. Rept. U. S. Geol. Surv.*, Part II, pp. 579-81, 1902; also *Science*, Vol. XIII, pp. 270, 271, 1901.

have not yet been thoroughly studied, but contain probably *Halobia rugosa*, Guembel, and two undetermined species.

The Jurassic.—Hyatt¹ described fossils from eastern Oregon which he thought came from Beaver creek, a tributary to Crooked river. The specimens are now in the Condon Museum, University of Oregon, and include, according to Hyatt:

Pecten acutiplicatus Meek.
Pholadomya nevadana Gabb.
Pholadomya multilineata Gabb.
Pleuromya concentrica Hyatt.
Cardinia gibbosum (?) Meek.
Rhynchonella sp.

These fossils did not come from Beaver creek, but from Silver river, over thirty miles east of Beaver creek, where they were found by William Day, of Dayville, Ore.

Professor Condon has obtained another collection made at Red Butte, Tp. 19 S., R. 30, about twenty miles north of Burns. This collection was sent to him by Mr. A. H. Huntington, of Baker City. It includes:

Pecten acutiplicatus Meek.
Pholadomya nevadana Gabb.
P. multilineata ? Gabb.
Entolium meeki Hyatt.

The third-mentioned form bears some resemblance to *P. inaequiplicata* Stanton. There are also some undetermined bivalves and ammonites in the collection. The fauna is that of the Hardgrave sandstone of Taylorville.²

Though the fossils studied by Hyatt did not come from Crooked river, it is probable that the Jurassic does occur there. In 1862 Professor Condon picked up a few shells on lower Beaver creek that seem to belong to that period. Mr. Stanton says of them:

The fossils from Beaver creek include a *Gryphea*, two casts of an *Ostrea*, a *Pecten*, and probably two species of *Rhynchonella* related to *R. gnathophora* Meek. I am unable to give specific identification of any of the forms, and they do not give any certain indication of the horizon from which they came.

¹ *Bull. Geol. Soc. Am.*, Vol. V, pp. 401, 418–20.

² *Bull. Geol. Soc. Am.*, Vol. V, p. 401.

They are certainly Mesozoic, however, and I think Jurassic rather than Cretaceous.

The Knoxville Cretaceous.—On petrographic and stratigraphic grounds Merriam¹ has recognized the Knoxville and the Chico near Mitchell, Wheeler county. His conclusions are supported by the evidence of the following fossils collected by Professor Condon in 1863 from various places between Mitchell and the John Day:

Olcostophanus sp.

Nautilus texanus (?) Shumard.

Acteonella oviformis Gabb.

Trigonia leana Gabb.

There are also two ammonites, one of them probably *Scaphites*, that the writer cannot classify. The first-mentioned form is a fragment that seems to be closely related to *O. Mutabilis* Stanton, a characteristic Knoxville species.² The other three species probably came from the strata that Merriam regarded as Chico. An interesting problem in Cretaceous geography will be solved when it can be proven that the Knoxville is present or absent in eastern Oregon, and it is to be hoped that someone will secure such proof. No *Aucellae* have yet been found there.

The Chico.—The first record of the Chico in eastern Oregon was made by Whitney,³ who published some fossils collected by Gabb on Crooked river. In the same year Blake⁴ described a *Turrilites* and other fossils that Professor Condon had collected at the same place. Since then several writers⁵ have referred to the Chico in eastern Oregon, from knowledge that they gained from Professor Condon's Spanish Gulch and Crooked river fossils. Recently Merriam⁶ has made large collections at the Spanish Gulch locality.

On upper Beaver creek John Platts and the writer made a

¹ *Bull. Dept. Geol., Univ. of Calif.*, Vol. II, p. 285, 1901.

² See STANTON, *Bull. U. S. Geol. Surv.*, No. 133, pp. 17, 18, 27, 77.

³ *Proc. Cal. Acad. Nat. Sci.*, Vol. III, p. 309, January, 1867.

⁴ *Am. Jour. Sci.*, July, 1867, p. 118.

⁵ See footnotes on first page of this paper.

⁶ *Bull. Dep't Geol., Univ. of Calif.*, Vol. II, pp. 418–20.

hasty collection of fossils, from dark-colored sandstones that were not unlikely the source of the earlier collections. The sandstone contains several beds of conglomerate, composed largely of pebbles of argillite and black chert. It dips gently northwest and rests unconformably upon the Paleozoic limestone mentioned above. Some of the fossils were obtained within a few feet of the limestone, in a conglomerate that contained an occasional pebble of the limestone. We did not have time to learn much about the distribution of the sandstone, but since the road up Crooked river had been entirely through Tertiary sediments and lavas, and the road beyond was through older rocks, it is not likely that the Chico covers much ground. Our collection was referred to Mr. Stanton, to whom we are indebted for the following list of species:

<i>Hemiaster californicus</i> Clark.	<i>Anthonya cultriformis</i> Gabb.
<i>Exogyra parasitica</i> Gabb.	<i>Meretrix varians</i> Gabb.
<i>Ostrea</i> sp.	<i>Dosinia elevata</i> Gabb.
<i>Gervillia</i> sp.	<i>Tellina</i> ? sp.
<i>Inoceramus</i> sp.	<i>Anatina quadrata</i> Gabb.
<i>Trigonia evansana</i> Meek.	<i>Pholadomya</i> sp.
<i>Homomya concentrica</i> Gabb.	<i>Acteonina californica</i> Gabb.
<i>Dentalium stramineum</i> Gabb.	<i>Tritonium</i> sp.
<i>Gyrodes expansa</i> Gabb.	<i>Fusus</i> sp.
<i>Lunatia</i> sp.	<i>Itruvius</i> sp.
<i>Amauropsis</i> sp.	<i>Desmoceras dawsoni</i> Whiteaves.

Mr. Stanton says:

The present collection is interesting from the fact that it contains a considerable number of new species. Nearly all the forms that are only generically determined appear to be undescribed. A larger collection of fossils from this locality, with a description of the beds in which they occur, is very desirable.

It is evident that the same need exists for all the Paleozoic and Mesozoic rocks of eastern Oregon.

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